Regency® COMMUNICATIONS INC.

SERVICE MANUAL

2805 TONE DECODER

MODEL MA-147

1227 S. PATRICK DR.
SATELLITE BEACH, FLA.

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SERVICE INSTRUCTIONS
REGENCY MA-147
2805 TONE DECODER

A. GENERAL DESCRIPTION

The MA-147, 2805 Decoder option, is a decoder to be used in a radio common carrier(RCC)system. The decoder decodes 2805Hz audio information in both long (7-digits) and short (4-digits) codes, upon receipt of a correct code the decoder opens the receiver squelch and turns on the call indicator.

The decoder is compatible with the MA-131, horn relay actuator option, and the MA-128 open channel scanner option. Care should be taken though when a non-recommended option is to be used with the MA-147. WHEN IN DOUBT CONSULT THE OPTION AND RADIO SCHEMATICS.

B. CIRCUIT DESCRIPTION (refer to schematic and wave form chart)

The incoming detected audio from the receiver enters the 2805 decoder at point AØ, where it is limited by CR1201 and CR1202. The audio then enters IC1202 at pin 3(audio level should be at least 200mVp-p). IC1201, a NE567, is a phase lock loop comprised of a reference oscillator, a phase comparitor, and a detector. The timing for the reference oscillator consists of R1201, R1202 & C1203 which are connected to Pins 5 & 6 of the I.C. The frequency of the reference oscillator can be measured by connecting a frequency counter to pin 5 (accessible at the top of R1201). Upon reception of a tone of the correct frequency, pin 8 of IC1201 will go to a logic "0" state ($\overline{\text{TONE}}$). The output of the tone detector is shaped and formed into various wave forms so the pulse train sent out by the base station can be properly decoded.

The logic signal TONE appears at the output of IC1205, Pin 10. Referring to the waveform chart, the TONE signal is at logic "1" (+5V) when the 2805 Hz tone is present and a logic "0" (0V) when the tone is interrupted. This signal is used to count the pulses of each digit. The signal is also fed into an integrater consisting of R1205, R1206, R1203 and C1208. The signal is then shaped by an inverter to produce DGT which can be observed at the output of IC1205 pin 12. This is fed to the compare enable switch (Q1201) where another signal is created to aid in the decoding of the 2805 Hz pulse train. This signal is called $\overline{\text{ENA}}$ and referring to the waveform chart the $\overline{\text{ENA}}$ pulse goes to a logic "0" after the end of the series of TONE pulses. The next pulse used to decode the 2805 Hz pulse train is the $\overline{\text{DDGT}}$ pulse. This is just the DGT pulse delayed (by R1209 and C1209) and inverted (by IC1205).

The $\overline{\text{ENA}}$ signal is inverted at IC1205 pin 4, and is delayed by R1224 and C1214. This delayed signal is then inverted by a Q1205 to obtain $\overline{\text{ADV}}$. There is also another signal to allow the decoder to receive a call. The K5 line must be grounded, that is, the mike has to be hung-up. This signal is ORed with the ENA signal by R1228, R1224 and CR1210.

When the base station initiates a call the operator brings up a 2805Hz tone on the air. Upon receiving the tone, the decoder logic is initially set (i.e., the digit counter is set to look at DØ and the pulse counter is set to zero and ready to convert the pulse train for the first digit. When the operator dials the first digit, the pulse counter, IC1202 which is a ripple counter, counts the positive transitions of the TONE wave form and outputs the count on the corresponding decimal line, (i.e., for a first digit of 3, the decimal 3 line out of IC1202, pin 4, will be high and all others are low).

These decimal lines along with the "D" lines of the digit-by-digit comparator, IC1203, form the patch field for the user's identification number. The digit-by-digit comparator takes the patched decimal line selected by the "D" line (according to the input code X,Y,Z) and outputs that logic level at pin 3,for a first digit of three, if three pulses are counted, X, Y and Z will all be zero which will select D1, so the output, pin 3 of IC1203 will go high after the third positive transition of TONE. The signal coming from pin 3 of IC1203 is called CD (correct digit).

The CD pulse is stretched by a pulse stretcher consisting of CR1205, C1212 and R1213 and inverted at pin 6 of IC1205, which is called the $\overline{SCD}$ signal.

If a correct digit is counted the $\overline{SCD}$ prevents the digit counter from being reset by the ENA signal. The SCD signal is held low until after the ENA signal returns to a logic "0" (due to the clarity of C1208). The digit counter is then advanced by the negative transitions of $\overline{ADV}$ from the time delay (R1224, C1214) and the inverter (Q1205). Thus, the counter sets up the comparitor to examine the next "D" line for the correct decimal output of the pulse counter.

If the digit was not correct then CD will not go high and $\overline{SCD}$ will not go low, allowing the digit counter to be preset to the program input code. The program input code is a binary zero for 7 digits long code or is a binary four for 4 digits short code. (The D program line, pin 11 of IC1204, is variable depending on the condition of D4).

If all of the digits are decoded correctly, short or long code, the outputs of the digit counter (outputs Q_b, Q_c and Q_d) all are high. This turns on Q1204 which allows DØ to go low, turning on the message lamp and through CR1211 latches the decoder by holding ENA high.

Lifting the microphone off hook allows the decoder to be reset by turning on Q1206 through CR1210 and R1228. This holds IC1204 in the loaded mode and no decoding can take place until the microphone is hung up.

C. INSTALLATION

Read thru all installation steps before proceeding. Refer to the schematic and layout diagrams as necessary.

1. Referring to Figure 2, install identification (ID) number jumpers.

   a. Locate the ID patch field. It can be found in the upper right hand corner.
   b. Wire the patch field by connecting the appropriate digit wire (brown to violet) to the corresponding decimal number for <u>that</u> digit

1. b.(cont.)

(do this from digits 1 to 7 of the I.D. numbers). If only a four digit code identification is desired, omit JU1211, JU1212 and JU1213.

Example: Setting up a table may be helpful and reduce the possibility of error.

I.D. Number --- 315-2643

Wire Color	Brn	Red	Org	Yel	Grn	Blu	Vio
Digit	D1	D2	D3	D4	D5	D6	D7
Decimal # of Digit	3	1	5	2	6	4	3

Referring to Figure 2:

Connect D1 (JU1211, Brn wire) to 3.
D2 (JU1212, Red wire) to 1.
D3 (JU1213, Org wire) to 5.
D4 (JU1214, Yel wire) to 2.
D5 (JU1215, Grn wire) to 6.
D6 (JU1216, Blu wire) to 4.
D7 (JU1217, Vio wire) to D1. (Note: This is the same as Digit 1 and is connected to Digit 1 in the hole provided.)

2. Remove jumper between K9 and K8 in the radio.

3. Install JO jumpers between the option board and the radio as follows:

a. JO1201 - connect BLUE wire from "AØ to AØ"
b. JO1202 - connect RED wire from "P5 to P5"
c. JO1203 - connect GREEN wire from "K9 to K9"
d. JO1204 - connect YELLOW wire from "K8 to K8"
e. JO1205 - connect WHITE wire from "D1 to D1" (ONLY USED WITH MA-131 HORN RELAY ACTUATER OPTION)
f. JO1206 - connect BROWN wire from "K5 to K5"
g. JO1207 - connect VIOLET wire from "DØ to DØ"
h. JO1208 - connect BLACK wire from "G to G"
i. JO1209 - connect RED wire from "P6 to P6" (ONLY USED WITH ANOTHER OPTION REQUIRING A 5 VOLT LINE, P6)
j. JO1210 - connect VIOLET wire from DØ on the decoder board to DØ on the open channel scanner, if open channel is used.

D. ADJUSTMENT PROCEDURE

1. Equipment

   a) RF Signal Generator
   b) 2805 Hz Dial Encoder
   c) Frequency Counter

2. Set up Conditions

   a) Hook up 13.8V to radio power plug
   b) Hook up radio to an unmodulated RF signal generator and set on selected receiving frequency.
   c) Receiver should be tuned up for normal performance.
   d) Hook up a fairly accurate (within ±1%) frequency counter to the top of R1201 on the decoder board (next to the frequency adjusting potentiometer).

3. The measured frequency should be 2805 Hz (±1Hz). If not, adjust frequency adjustment pot, R1202, to obtain 2805 Hz (±1Hz).
   Note: Be sure no tones are present at the audio input, especially near 2805 Hz, when measuring this frequency. IC1201 is a phase locked loop and input tones may cause it's reference oscillator to be "steered" away from it's free-running frequency.

4. Modulate the signal generator with the 2805 Hz from the dial encoder, setting the deviation at ±3 KHz.

5. Disconnect the frequency counter from the top of R1201.

6. Turn the receiver squelch control to the fully open condition. Now ground the microphone hang-up button, this should squelch the radio.

7. Dial the seven digit I.D. number. The receiver squelch should open and the message LED should light. Unground the microphone hang-up button for a moment and then re-ground it. This should resquelch the receiver.

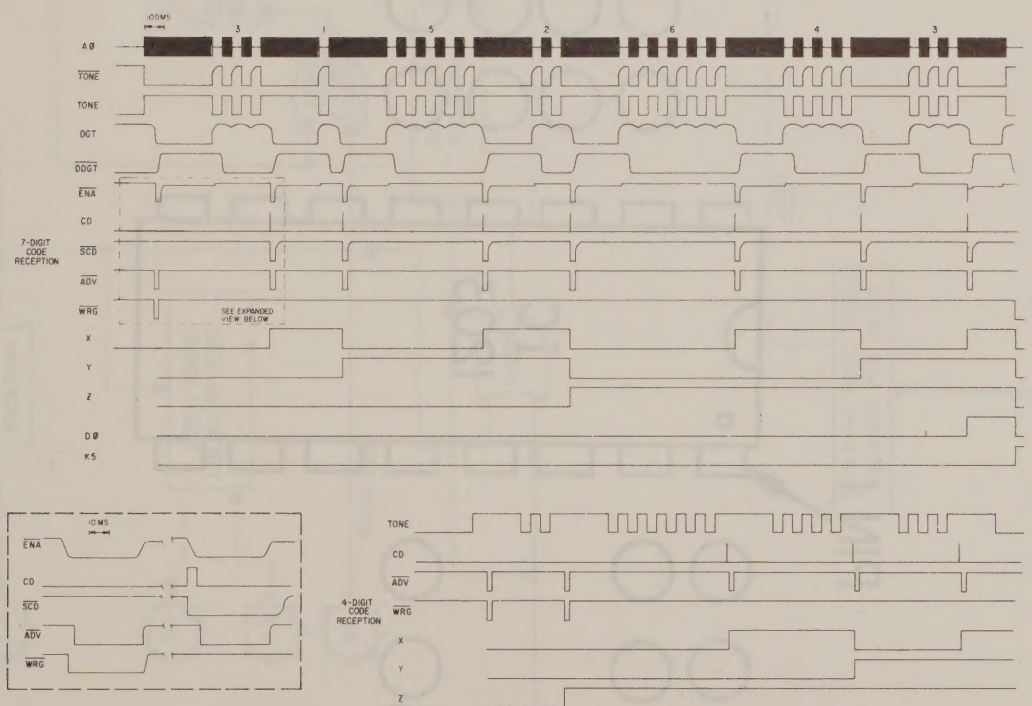
8. Repeat step G using the four digit code. Results should be identical.

9. If trouble has been encountered, check the jumper hook-up first. If problems still exist, refer to the schematic and theory of opeation to troubleshoot the decoder.

E. SPECIFICATIONS

SINGALING

Interrupted Single 2805 Hz Tone	Pulse Rate: 8-20pps Interdigit Time: 150 ms min.
AUDIO INPUT IMPEDANCE	Greater than 5K ohms
AUDIO INPUT LEVEL	200mV RMS min.
SIGNAL TO NOISE RATIO	2dB
SUPPLY VOLTAGE RANGE	7V to 18V
SUPPLY CURRENT	30ma
OPERATING TEMPERATURE	-30°C to +65°C



2805 DECODER WAVEFORM CHART

FIGURE 1

I.D. NUMBER PATCH FIELD

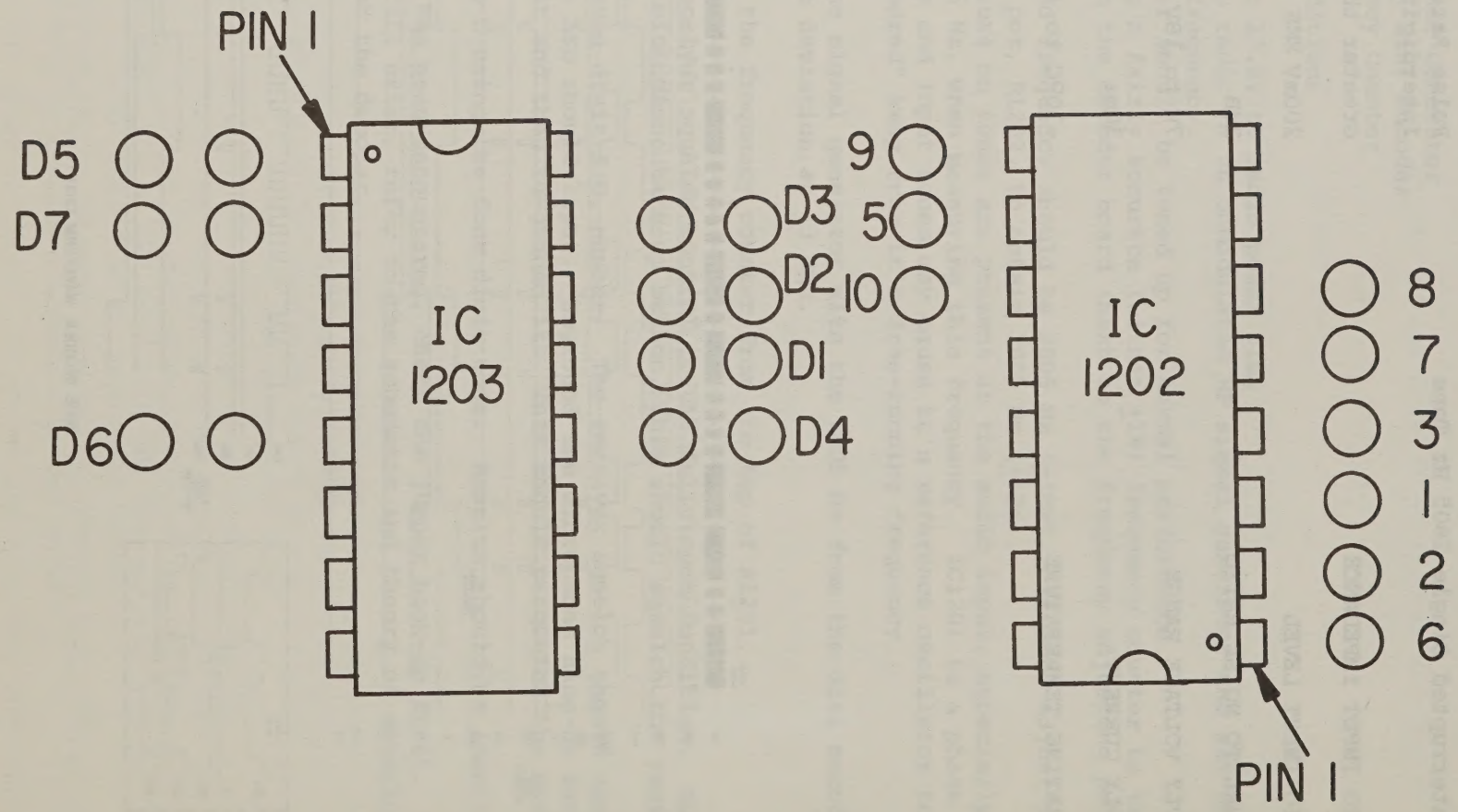


FIGURE 2

BLOCK DIAGRAM 2805 DECODER / MA147

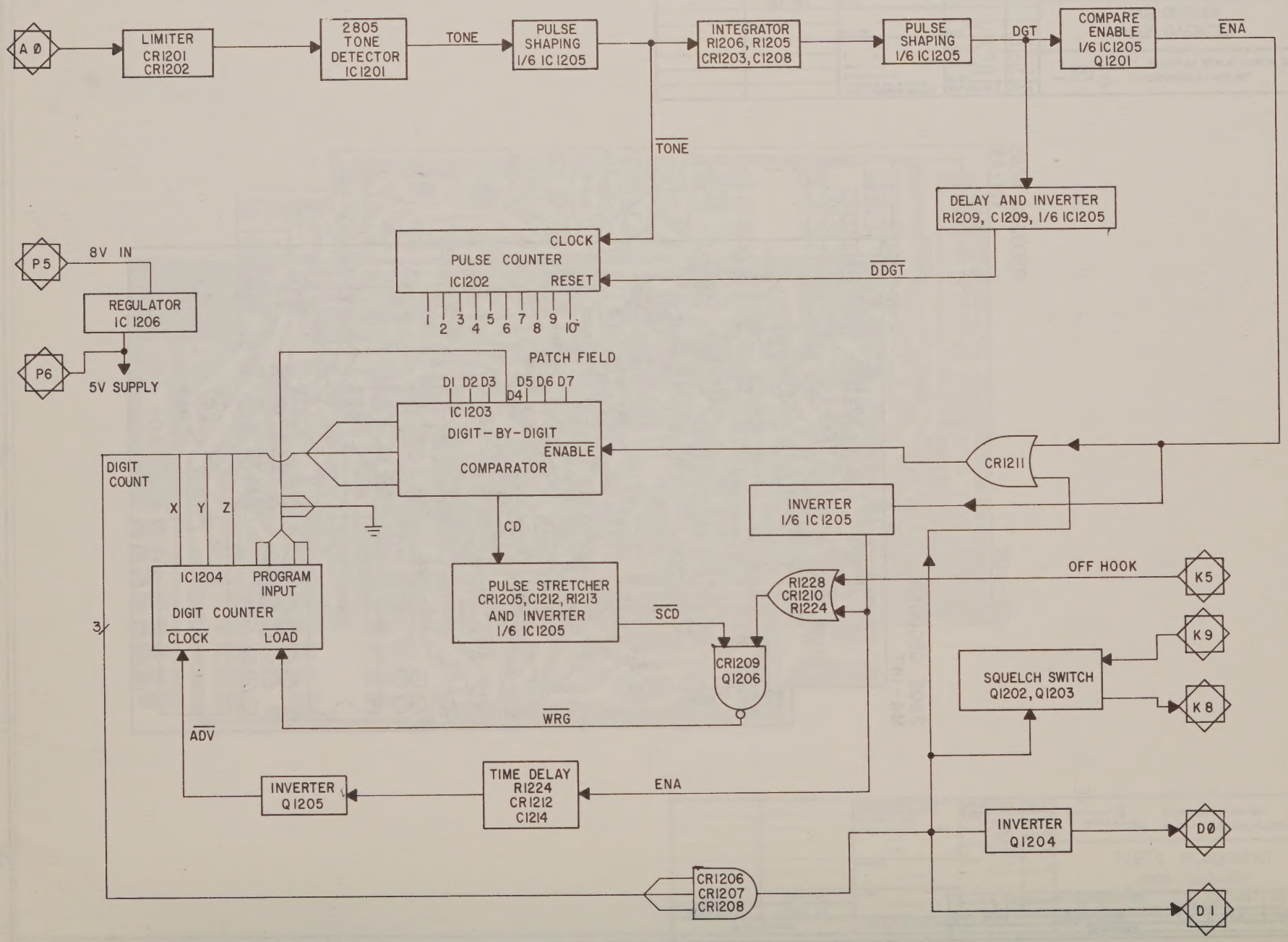
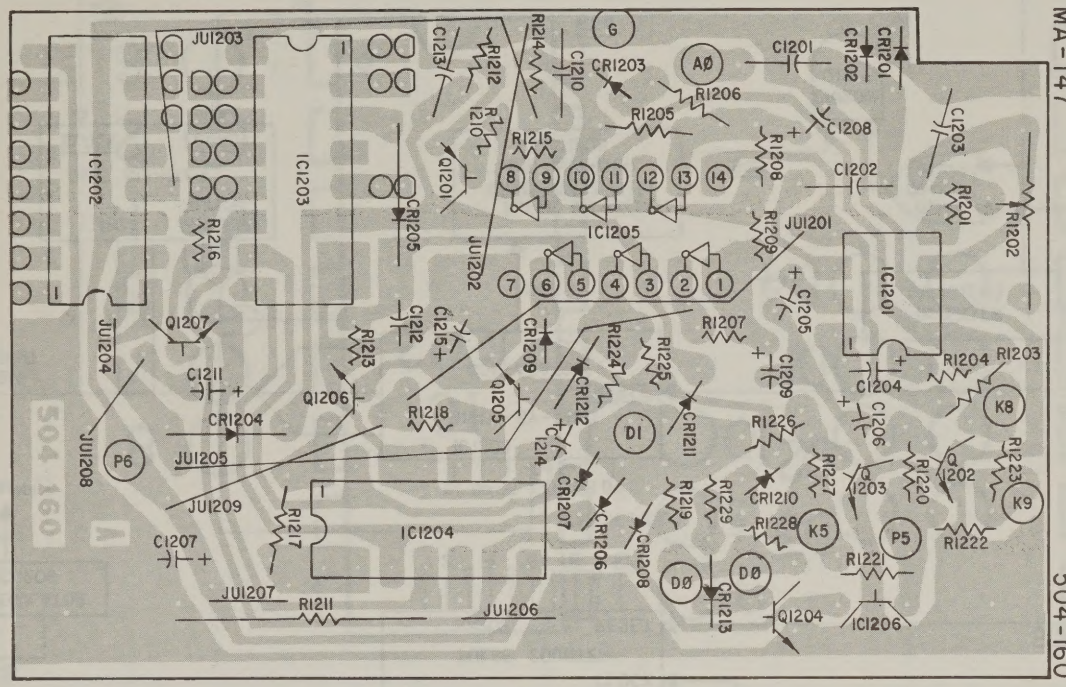


FIGURE 3



REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
—	A	RELEASE 2.015	5-9-78	MB

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACT. ± DEC. .xx± .xxx± ANGLE ±	APPROVALS	DATE
		MATERIAL	DRAWN WCWCL.	4-25-78
		FINISH	CHECKED MB	5-7-78
—	MA-147		DFTG. SUPV. MB	5-9-78
NEXT ASSY	USED ON		ENGR. HT	5-9-78
APPLICATION		DO NOT SCALE DWG.		

Regency® COMMUNICATIONS INC.
SATELLITE BEACH, FLORIDA 32937

PARTS OVERLAY
2805 DECODER

SIZE	PART NUMBER	REV.
C	504-164	A

SCALE 4/1 SHEET 1 OF 1

DWG. NO. 504-164 SH REV. A

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-2307

FIGURE 4

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
—	A	RELEASE R-015	5-9-78	

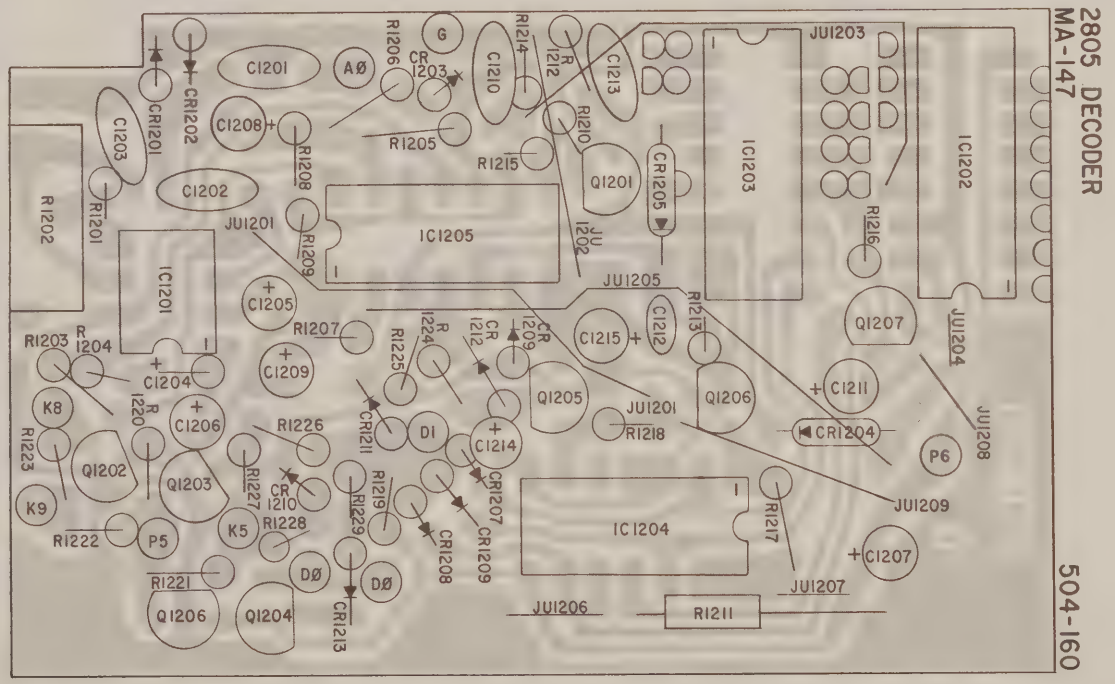


FIGURE 5

-9-

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE FRACT ± DEC. xx± .xxx± ANGLE ±	APPROVALS	DATE	Regency® COMMUNICATIONS INC. SATELLITE BEACH, FLORIDA 32937
			DRAWN	5-8-78	PARTS PLACEMENT 2805 DECODER
			CHECKED	5-9-78	
			DFTG. SUPV	5-9-78	
		MATERIAL —	ENGR.	5-9-78	
—	MA-147	FINISH —			SIZE C PART NUMBER 504-163 REV. A
NEXT ASSY	USED ON				SCALE 4/1 SHEET 1 OF 1
APPLICATION		DO NOT SCALE DWG.			

DWG. NO. 504-163 SH REV. A

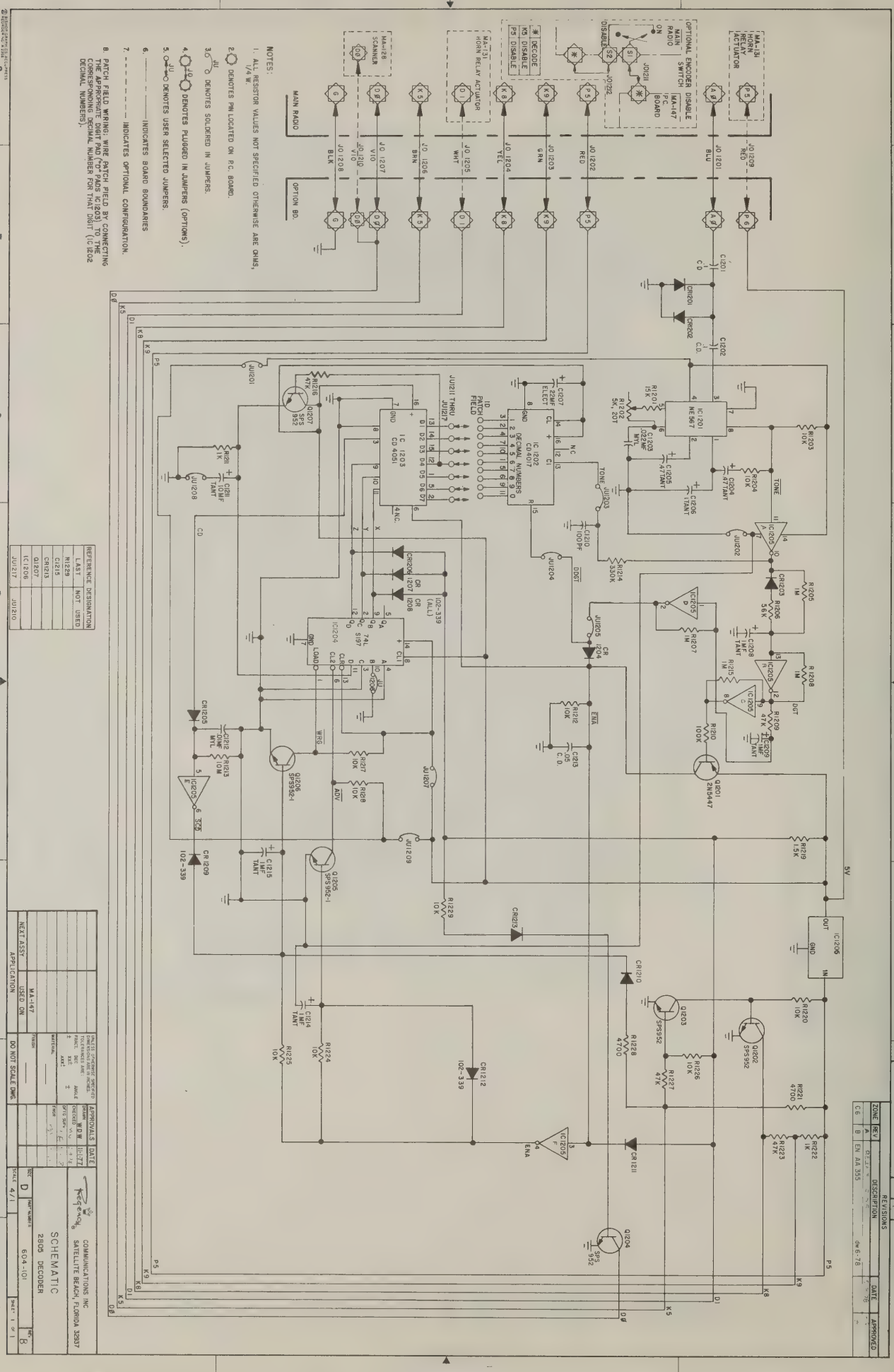

SCHEMATIC
2805 DECODER
604-101
COMMUNICATIONS INC
SATELLITE BEACH, FLORIDA 32937
NOTES:
1. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, 1/4 W.
2. DENOTES PWB LOCATED ON P.C. BOARD.
3. DENOTES SOLDERED IN JUMPERS.
4. DENOTES PLUGGED IN JUMPERS (OPTIONS).
5. DENOTES USER SELECTED JUMPERS.
6. INDICATES BOARD BOUNDARIES
7. INDICATES OPTIONAL CONFIGURATION.
8. PATCH FIELD WIRING: WIRE PATCH FIELD BY CONNECTING THE APPROPRIATE DIGIT PAD ("O" PADS IC1203) TO THE CORRESPONDING DECIMAL NUMBER FOR THAT DIGIT (IC 1202 DECIMAL NUMBERS).
REFERENCE DESIGNATION
LAST NOT USED
R1229
C1215
CR1213
Q1207
IC1206
JU1217
JU1210
MA-147 USED ON
NEXT ASSY APPLICATION
DO NOT SCALE DWG.
APPROVALS
DATE
DWG NO 604-101
REV
ZONE
DESCRIPTION
DATE
APPROVED
SCALE 4/1
SHT 1 OF 1

FIGURE 6

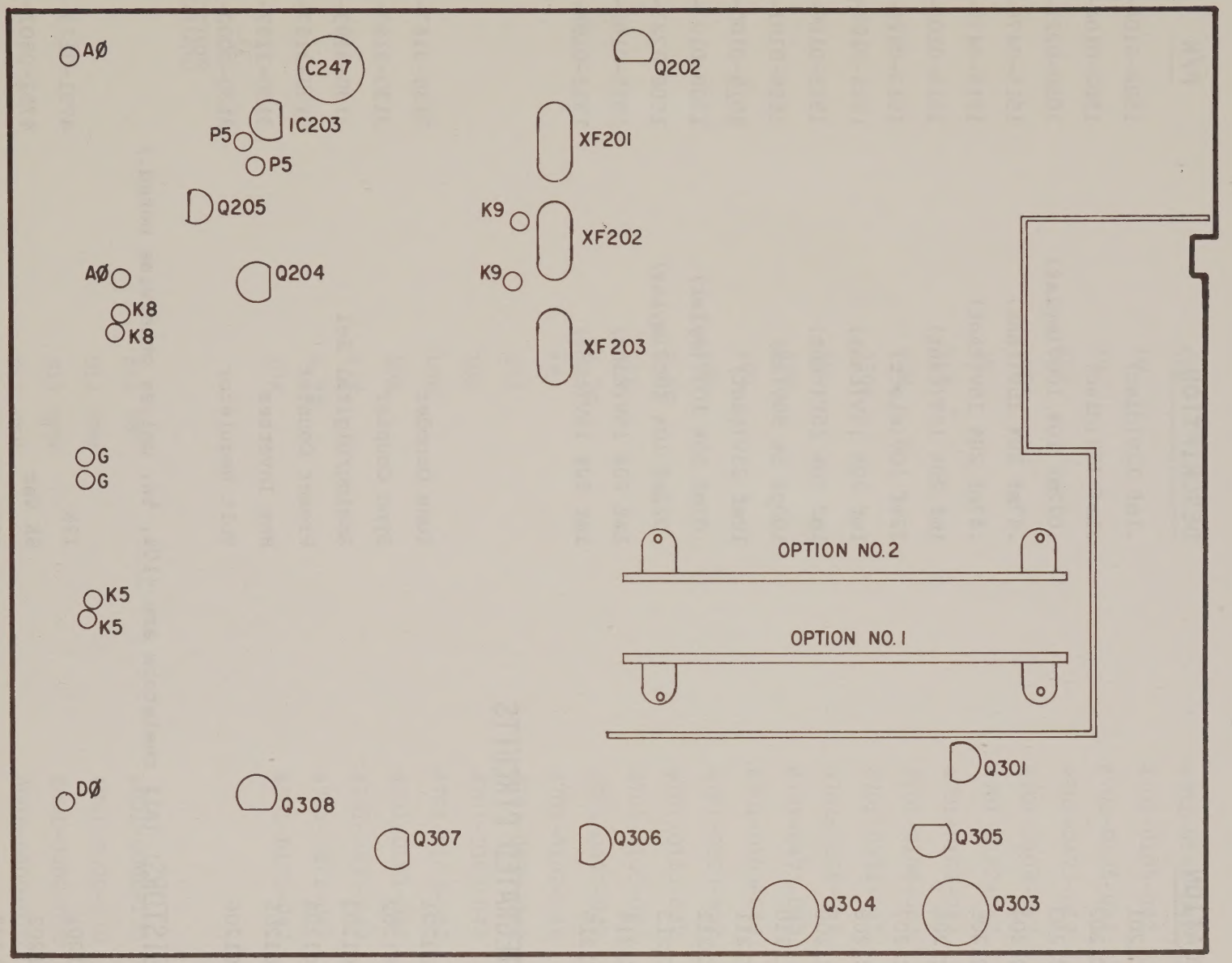

AØ
C247
Q202
P5
IC203
XF201
P5
Q205
K9
XF202
AØ
Q204
K9
K8
K8
XF203
G
G
OPTION NO. 2
K5
K5
OPTION NO. 1
Q301
DØ
Q308
Q307
Q306
Q305
Q304
Q303

FIGURE 7

PARTS LIST
MA-147

CAPACITORS

LOCATION	DESCRIPTION	P/N
C1201	.1mf 12V(disc)	1502-0104-005
C1202	.1mf 12V(disc)	1502-0104-005
C1203	.022mf 10% 100V(mylar)	1058-0223-610
C1204	.47mf 20% 15V(tant)	1515-0478-003
C1205	.47mf 20% 15V(tant)	1515-0478-003
C1206	1mf 20% 15V(tant)	1515-0109-003
C1207	22mf 10V(elect)	1513-0220-001
C1208	1mf 20% 15V(tant)	1515-0109-003
C1209	1mf 20% 15V(tant)	1515-0109-003
C1210	100pf 5% 50V(sm)	1506-0101-550
C1211	10mf 25V(tant)	1515-0100-005
C1212	.01mf 10% 100V(mylar)	1508-0103-610
C1213	.022mf 10% 100V(mylar)	1508-0223-610
C1214	1mf 20% 15V(tant)	1515-0109-003
C1215	1mf 20% 15V(tant)	1515-0109-003

INTEGRATED CIRCUITS

IC1201	Tone Decoder	3130-3167-902
IC1202	Sync Counter	3130-3193-516
IC1203	Analog/Digital Sel	3130-3193-517
IC1204	Preset Counter	3130-3157-641
IC1205	Hex Inverter	3130-3157-617
IC1206	Volt Regulator	3130-0000-013

RESISTORS (All resistors are ±10%, ¼W, unless otherwise noted.)

R1201	12K	4701-0123-042
R1202	5K Var	4751-0502-007
R1203	10K	4701-0103-042
R1204	10K	4701-0103-042
R1205	1M	4701-0105-042

RESISTORS (cont.)

LOCATION	DESCRIPTION	P/N
R1206	56K	4701-0563-042
R1207	1M	4701-0105-042
R1208	1M	4701-0105-042
R1209	47K	4701-0473-042
R1210	100K	4701-0104-042
R1211	1K	4701-0102-042
R1212	10K	4701-0103-042
R1213	10M	4701-0106-042
R1214	330K	4701-0334-042
R1215	1M	4701-0105-042
R1216	47K	4701-0473-042
R1217	10K	4701-0103-042
R1218	10K	4701-0103-042
R1219	1.5K	4701-0152-042
R1220	10K	4701-0103-042
R1221	4.7K	4701-0472-042
R1222	1K	4701-0102-042
R1223	47K	4701-0473-042
R1224	10K	4701-0103-042
R1225	10K	4701-0103-042
R1226	10K	4701-0103-042
R1227	47K	4701-0473-042
R1228	4.7K	4701-0472-042
R1229	10K	4701-0103-042

TRANSISTORS

Q1201	Sil PNP	4801-0000-135
Q1202	Sil NPN	4801-0000-010
Q1203	Sil NPN	4801-0000-010
Q1204	Sil NPN	4801-0000-010
Q1205	Sil NPN	4801-0000-013
Q1206	Sil NPN	4801-0000-013
Q1207	Sil NPN	4801-0000-010

DIODES

LOCATION	DESCRIPTION	P/N
CR1201	Sil	4805-1241-200
CR1202	Sil	4805-1241-200
CR1203	Sil	4805-1241-200
CR1204	Sil	4805-1241-200
CR1205	Sil	4805-1241-200
CR1206	Ger	4807-1233-900
CR1207	Ger	4807-1233-900
CR1208	Ger	4807-1233-900
CR1209	Ger	4807-1233-900
CR1210	Sil	4805-1241-200
CR1211	Sil	4805-1241-200
CR1212	Ger	4807-1233-900
CR1213	Sil	4805-1241-200